

\*\*\*\*\* AMERICAN WOODCOCK \*\*\*\*\*

\*\*\* NORMALIZING AND CONTACT RATE FACTORS \*\*\*

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
<b>BODY WEIGHT</b>													
Dwyer et al. 1988	A	M	-	SP	134.6	2.9 SE	g - April			16	Maine 1976-85	NS	
	A	M	-	SP	133.8	5.8 SE	g - May			22			
	A	M	-	SU	151.2	9.5 SE	g - June			6			
Greeley 1953	A	M	-	FA	168	1.8 SE	g			45	Wisconsin	NS	As cited in Sheldon 1967.
	A	F	-	FA	209	2.1 SE	g			57			
	J	M	-	FA	169	2.1 SE	g			36			
	J	F	-	FA	212	2.4 SE	g			47			
Keppie & Redmond 1985	A	M	-	SP	134.8	7.9 SD	g	116	160	213	ne New Brunswick, CAN	NS	
Marshall (unpubl.)	B	M	-	FA	166		g			171	Minnesota	NS	As cited in Sheldon 1967.
	B	F	-	FA	212		g			221			
Marshall (unpubl.)	A	M	-	FA	169		g			71	Minnesota	NS	As cited in Sheldon 1967.
	J	M	-	FA	164		g			100			
	A	F	-	FA	213		g			109			
	J	F	-	FA	212		g			112			
Nelson & Martin 1953	A	M	-	-	176		g		221	390	United States	NS	Data from USFWS records (from bird banders, game bag investigations).
	A	F	-	-	218		g		278	313			
Owen & Krohn 1973	A	M	-	-			g	125	190		NS	NS	As cited in Owen et al. 1977.
	A	F	-	-			g	160	240				
Sheldon 1967	A	M	-	SU	145.9		g	127	165	31	c MA 1956-57	NS	Similar data for fewer birds caught in 1957. No variance estimates provided.
	J	M	-	SU	140.4		g	117	152	49			
	A	F	-	SU	182.9		g	162	216	48			
	J	F	-	SU	168.8		g	151	192	24			
Sheldon 1967	A	M	-	FA	166		g			57	New Brunswick, CAN	NS	
	A	F	-	FA	208		g			75			
Sheldon (unpubl.)	A	M	-	FA	163		g			31	Vermont	NS	As cited in Sheldon 1967.
	A	F	-	FA	199		g			33			
Tufts 1940	A	M	-	FA	176		g			87	Nova Scotia, CAN	NS	As cited in Sheldon 1967.
	A	F	-	FA	219		g			92			

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
<b>EGG WEIGHT</b>													
Gregg 1984	-	-	1	-	18-19		g			44	Wisconsin	forest, open areas	Weight at: (1) laying; (2)
	-	-	2	-	14-16		g			44	1967-80	brush	hatching.
Rabe et al. 1983b	-	-	-	-	17		g				NS	NS	G. A. Ammann pers. comm.
Wetherbee & Wetherbee 1961	-	-	-	-	15.5		g			3	NS	NS	Egg weight just prior to hatching. As cited in Sheldon 1967.
<b>HATCHING WEIGHT</b>													
Gregg 1984	H	-	-	-	13.0		g	9	16	42	Wisconsin 1967-80	wild (forest, open areas, brush) and captive	Newly hatched chicks.
<b>CHICK GROWTH RATE</b>													
Dwyer et al. 1982	C	M	-	-	5.1		g/day				Maine 1977-80	mixed forests, field	Chicks recaptured in the field
	C	F	-	-	6.2		g/day						(total of 338 chicks with 22 to 43% recapture rate over 4 year study). From 5 days (40 g both sexes) to 17 days of age (females 115 g, males 105 g).
<b>METABOLIC RATE (KCAL BASIS)</b>													
Rabe et al. 1983b	A	F	B	-	115		kcal/kg-d				s Michigan	generic	Basal (B) metabolic rate computed
	A	F	FL	SP	315		kcal/kg-d				1965-80		from equation from Aschoff and Pohl
	A	F	BR	SU	553		kcal/kg-d						1970. Free-living (FL) MR based on energy budget model and temperatures typical for March in Michigan. Breeding (BR) energy requirement estimated for egg laying peak needs. All assuming female weight of 190 grams.
<b>FOOD INGESTION RATE</b>													
Sheldon 1967	A	B	-	SU	1.0		g/g-day				Massachusetts 1958-64	captive	Birds ate an average of 150 g of earthworms a day (water provided ad libitum); 150 g "approximated" the summer weight of the birds.

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Stickel et al. 1965	-	B	1	WI	0.77		g/g-day	0.11	1.43	23	Louisiana 1961	captive	(1) Fed heptachlor contaminated and untreated earthworms; (2) fed untreated earthworms only. Difference in ingestion rates not significant.
	-	B	2	WI	0.73		g/g-day	0.11	1.27	11			

\*\*\* DIET \*\*\*

Reference	Age	Sex	Food type	Spring	Summer	Fall	Winter	N	Location	Habitat - Measure	Notes
Aldous 1938	-	-	earthworms coleoptera diptera other animal Rubus (seeds) other plant			87.4 3.8 1.4 3.5 2.2 1.7		55	Maine	habitat NS - measure NS; % stomach contents	Data from October. As cited in Trippensee 1948.
Krohn 1970	B	B	earthworms coleoptera diptera arachnida		83.4 15.2 0.6 0.8			36	Maine 1968-69	woods - % wet weight; mouth, esophagus, proventriculus, and stomach contents	Grit removed. See next entry for relative weight of grit.
Krohn 1970	B	B	earthworms beetle larvae grit other		58 10 31 1			36	Maine 1968-69	fields - % wet weight; mouth, esophagus, proventriculus, and stomach contents	Immature males most common; few adult females present. Illustrates high consumption of grit by weight. Grit comprised only 14 percent of the volume, however; see next entry.
Krohn 1970	B	B	earthworms beetle larvae grit other		68 15 14 3			36	Maine 1968-69	fields - % wet volume; mouth, esophagus, proventriculus, and stomach contents	Immature males most common; few adult females present.
Mendall & Aldous 1943	-	-	animal plant		94.2 5.8				NS	habitat NS - measure NS; % stomach contents	Evidence of plant consumption. As cited in Trippensee 1948.
Miller & Causey 1985	-	-	earthworms coleoptera hymenoptera				87 11 2	13	Alabama	habitat NS - % volume; esophagus contents	Food collected from mouth and esophagus only. Should provide an accurate representation of the earthworms present.

Reference	Age	Sex	Food type	Spring	Summer	Fall	Winter	N	Location	Habitat - Measure	Notes
Miller & Causey 1985	-	-	earthworms centipedes coleoptera diplura diptera				71 11 8 2 7	29	Alabama	habitat NS - % volume; proventriculus contents	Food collected from proventriculus only. May be somewhat biased against soft bodied earthworms.
Sheldon 1967	A	B	Coleoptera Diptera Lepidoptera Annelida other		38.7 15.3 14.7 30.0 1.1			15	NS	fields - % volume; stomach contents	Data from Table N; location of collection not specified.
Sperry 1940	A	B	earthworms diptera larvae coleoptera lepidoptera other insects other animals plants		67.8 6.9 6.2 3.3 2.0 3.3 10.5			261	North America	habitat NS - % volume; stomach contents	Sampling covered 10 months of the year, March through December, and 16 states, DC, and 3 Canadian provinces. Coleoptera included ground beetles and click beetles; lepidoptera included caterpillars and moths; plant material included many seeds and some debris.
Stribling & Doerr 1985	A	B	earthworms other				99+ <1	15	N Carolina 1978-82	soybean fields - % wet weight; digestive tract	Contents of esophagus, proventriculus, and gizzard. Two genera other than earthworms consumed: Aporectodea and Diplocardia.

\*\*\* POPULATION DYNAMICS \*\*\*

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
<b>HOME RANGE SIZE</b>													
Dunford & Owen 1973	J	B	-	SU	332	78	SE m movement			113	Maine 1969-70	woods, fields	Distance moved between day and night sites - total of 133 flights. 15 radio-tagged birds tracked for a total of 183 woodcock-days.
Gregg 1984	B	F	-	SU	4.5		ha/brood			1	Wisconsin 1967-80	woods, open areas, brush	Minimum home range of one radiotagged brood (hen and chicks) followed from six days after hatching until the brood broke up at 32 days.

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Gregg 1984	B	B	-	SU	32.4	27.6	SD ha	7	98	16	n Wisconsin 1976-78	forest, open areas, brush	Based on radiotracked individuals; data were not separated by age or sex due to differences in time followed and sample sizes between groups. Sample included 4 adult females, 3 adult males, 7 immature females, and 2 immature males followed between 12 and 101 days in summer-early fall.
Hudgins et al. 1985	A	M	1	SP	3.1		ha	0.3	6.0	2	Pennsylvania 1980-81	mixed trees, shrubs and fields	Median values reported (not means). Estimated using data from radio-tagged males and the minimum-area home range method: (1) generally inactive males; (2) generally active males, and (3) males known to be singing.
	A	M	2	SP	73.6		ha	38.2	171.2	6			
	A	M	3	SP	10.5		ha	4.6	24.1	4			
Owen & Morgan 1975	A	B	-	SU	170	17	SE m movement			271	Maine 1971-73	woods, fields	Distance moved between day and night sites; N = number of flights. Radio-tagged birds tracked for a total of 271 movements between diurnal and nocturnal sites.
<b>POPULATION DENSITY</b>													
Connors & Doerr 1982	B	B	1	WI	3.38		N/ha			108	N Carolina 1977-78	agricultural fields	Density of roosting woodcock in (1) untilled soy stubble; (2) untilled corn stubble; (3) rebedded corn fields. None were found in winter wheat fields. N = number of hectares sampled.
	B	B	2	WI	0.202		N/ha			79			
	B	B	3	WI	0.034		N/ha			29			
Coon et al. 1982	-	-	-	SP	0.21		nests/ha			34	Pennsylvania 1972-74	mixed forests, plantations	Habitat a mixture of pine and hardwood forests, old fields, pine plantations, and mixed plantations.
Dwyer et al. 1988	B	B	-	SU	0.223		N/ha	0.190	0.250		Maine 1976-83	second growth forest, meadows, ponds	On wildlife refuge. Forest consisted of spruce and balsam fir, birch, red maple, and aspen, as well as meadows and abandoned fields and clearcuts. Average and minimum and maximum of 4 to 5 years of density estimates made using mark-recapture method.
	A	M	-	SU	0.035		N/ha	0.026	0.046				
	A	F	-	SU	0.056		N/ha	0.037	0.074				
	J	B	-	SU	0.125		N/ha	0.108	0.143				
Godfrey 1974	A	M	-	SP	0.017		sing M/ha				Minnesota 1967-70	forest	Density of singing males in 1,600 ha of the Cloquet Forest. As cited in Gregg 1984.

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Johnson & Causey 1982	B	B	1	WI	0.41		N/ha				sc Alabama 1979-80	longleaf pine stands	Density of areas burned in: (1) the same winter; (2) 1 year before; and (3) mean of value for areas burned 2, 3, and 10 years before. Authors suggest that standing vegetation at ground level and thick layers of pine litter that occur two or more years after burning decrease value of habitat for feeding and inhibit movement.
	B	B	2	WI	0.09		N/ha						
	B	B	3	WI	0.03		N/ha						
Mendall & Aldous 1943	A	M	-	SP	0.10		sing M/ha				Maine 1939	NS - known breeding habitat	Peak yearly value for density of singing males in 607 ha area. As cited in Gregg 1984.
Norris et al. 1940	A	M	-	SP	0.10		sing M/ha				Pennsylvania 1939	moist ("best") area in barrens	Density of singing males on 385 ha. As cited in Gregg 1984.
Sheldon 1967	A	M	-	SP	0.049		sing M/ha				Massachusetts 1951	forest	Entire Quabbin Reservation (35,600 ha); includes both suitable and unsuitable habitat.
<b>CLUTCH SIZE</b>													
Bent 1927	-	-	-	-	4			3	5		throughout range	NS	
Gregg 1984	-	-	-	-	4			2	4	220	Wisconsin 1967-80	forest, open areas, brush	89% of complete clutches contained four eggs; actual mean not presented.
McAuley et al. 1990	-	-	1	-	3.8	0.42 SD					Maine 1977-80	mixed	(1) First clutch; (2) second clutch if first clutch destroyed or brood lost.
	-	-	2	-	3.0	0.67 SD							
Mendall & Aldous 1943	-	-	-	-	4						NS	NS	As cited in Owen et al. 1977.
Pettingill 1936	-	-	-	-	4			3	5		NS	NS	As cited in Trippensee 1948.
<b>DAYS INCUBATION</b>													
Bent 1927	-	-	-	-	20-21		days				NS	NS	
Gregg 1984	-	-	-	-	20-22		days			7	Wisconsin 1967-80	forest, open areas, brush	

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Gregg 1984	A	M	-	SP	0.067		N/ha				Wisconsin 1967-80	aspen forest, open areas, brush, alder	Includes singing and non-singing males (estimated by multiplying the number of singing males by 1.3). Female value was estimated from the male value assuming an adult sex ratio of 0.61 M/F. Habitat described as "good."
	A	F	-	SP	0.11		N/ha						
Gregg 1984	-	-	-	SP	0.11		nests/ha		0.75		Wisconsin 1967-80	aspen forest, open areas, brush, alder	Mean is a rough estimate based on female density (described above). Maximum is density found in a 12 ha area described as the "best available breeding habitat" in the study area.
Mendall & Aldous 1943; Pettingill 1936	-	-	-	-			days	19	21		NS	NS	As cited in Trippensee 1948.
<b>AGE AT FLEDGING</b>													
Gregg 1984	-	-	-	-	18-19		days				Wisconsin 1967-80	forest, open areas, brush	Fledging defined as able to sustain flight for at least 100 m.
<b>N FLEDGE/SUCCESSFUL NEST</b>													
Gregg 1984	-	-	-	-	3.5		N/suc nest			104	Wisconsin 1967-80	forest, open areas, brush	Successful nest = nest hatching young.
<b>PERCENT NESTS SUCCESSFUL</b>													
Gregg 1984	-	-	-	-	48.5	11.6 SD	% nest suc	29	67	220	Wisconsin 1967-80	forest, open areas, brush	Success defined as hatching at least one egg. Mean of 12 yearly values. N = total number of nests (all years).
McAuley et al. 1990	-	-	1	-	50		% nest suc				Maine 1977-80	mixed	(1) Percent nests initiated that hatched; (2) percent females that hatched one nest (reflects re nesting attempts).
	-	-	2	-	75		% female suc						
<b>AGE AT SEXUAL MATURITY</b>													
Sheldon 1967	A	M	-	SP	< 1		yr				NS	NS	From data on age of singing males. Birds not examined for fertile sperm.
	A	F	-	SP	1		yr						

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
<b>ANNUAL MORTALITY</b>													
Dwyer et al. 1988	N	B	-	SU	41		% fledge				Maine 1976-83	conifer and hardwood forests, mixed with open areas	Percent mortality of chicks from hatching to fledging.
Dwyer & Nichols 1982	A	M	E	-	65	5.2 SD	%/yr				ne & nc US 1967-77	NS	E = northeastern United States (New England, NY, NJ, PA, MD); C = north central US (WI, MI). Birds banded from May - July 1967-77 and recovered in September and February of following years.
	A	M	C	-	60	15 SD	%/yr						
	J	M	E	-	80	4.8 SD	%/yr						
	J	M	C	-	64	12 SD	%/yr						
	A	F	E	-	51	7.3 SD	%/yr						
	A	F	C	-	47	9.6 SD	%/yr						
	J	F	E	-	64	7.7 SD	%/yr						
	J	F	C	-	69	9.4 SD	%/yr						
Gregg 1984	B	M	-	-	48	4.1 SE	%/yr				Wisconsin 1967-80	forests, open areas, brush	Based on band recovery study - hunted population.
	B	F	-	-	46	4.8 SE	%/yr						
Krohn et al. 1974	A	M	-	-	62		%/yr				Maine	NS	As cited in Derleth and Sepik 1990.
	A	F	-	-	63		%/yr						
	J	M	-	-	75		%/yr						
	J	F	-	-	63		%/yr						
Sheldon 1967	A	M	-	-	47		%/yr			384	throughout range	NS	Data from wings sent in by hunters for wing-collection survey sponsored by US Fish and Wildlife Service. Years of collection not specified.
	A	F	-	-	38		%/yr			638			

#### LONGEVITY

Gregg 1984	-	M	-	-	1.5		years		8		Wisconsin 1967-80	forests, open areas, brush	Based on banding analysis; a few old age birds were recovered after the analyses were complete so values may be an underestimate. Maximum values are oldest recovered birds in study.
	-	F	-	-	1.6		years		11				

#### \*\*\* SEASONAL ACTIVITIES \*\*\*

Reference	Begin	Peak	End	Location	Habitat	Notes
<b>MATING/LAYING</b>						
Dwyer et al. 1982	earl Apr			Maine 1977-80	conifer and hardwood forests mixed with open fields	



Reference	Begin	Peak	End	Location	Habitat	Notes
Rabe et al. 1983a		end Mar		Michigan	NS	
Whiting & Boggus 1982	earl Feb		mid Mar	Texas 1979-80	pine plantation	
<b>HATCHING</b>						
Dwyer et al. 1982		mid May		Maine 1977-80	conifer and hardwood forests mixed with open fields	
Pettingill 1936	earl Feb			Louisiana	NS	As cited in Sheldon 1967.
Pettingill 1936	earl Feb			Georgia	NS	As cited in Sheldon 1967.
Pettingill 1936	late Feb			Virginia	NS	As cited in Sheldon 1967.
Pettingill 1936	earl Mar			New Jersey	NS	As cited in Sheldon 1967.
Pettingill 1936	late Mar			Connecticut	NS	As cited in Sheldon 1967.
Pettingill 1936	mid Apr			Maine	NS	As cited in Sheldon 1967.
Rabe et al. 1983a		earl May		Michigan	NS	
Sheldon 1967	mid Apr	earl May	earl Jun	Massachusetts 1950-61	NS	
Wright (unpubl.)	late Apr	earl May		New Brunswick, CAN	NS	As cited in Sheldon 1967.
<b>FALL/BASIC MOLT</b>						
Owen & Krohn 1973		Aug-earl Sep		NS	NS	Both adults and juveniles undergo extensive molts. Cited in Owen et al. 1977.
<b>FALL MIGRATION</b>						
Owen et al. 1977	late Sep		mid Dec	from Canada	NS	By mid-December, most birds have reached the southern wintering grounds.
Sheldon 1967	Oct		Dec	arrive N Carolina	NS	Summarizing other studies.
Sheldon 1967		Oct		leave New York	NS	Summarizing other studies.

Reference	Begin	Peak	End	Location	Habitat	Notes
Sheldon 1967		earl Oct		leave Pennsylvania	NS	Summarizing other studies.
Sheldon 1967		earl Nov		leave Ohio	NS	Summarizing other studies.
Sheldon 1967		late Nov	earl Dec	arrive Louisiana	NS	
Sheldon 1967		late Nov		leave Kentucky	NS	Summarizing other studies.
<b>SPRING MIGRATION</b>						
Connors & Doerr 1982	mid Feb		earl Mar	leave N Carolina	farm, woods, thicket	
Gregg 1984	Mar	Apr		arrive Wisconsin	forest, open, brush	
Owen et al. 1977	Jan	Feb		s part winter range	NS	Beginning spring migration.
Owen et al. 1977		Mar	Apr	northern range	NS	Arrival in northerly breeding grounds.
Sheldon 1967		Feb		leave Louisiana	NS	
Sheldon 1967		Mar		through Kentucky	NS	Summarizing other studies.
Sheldon 1967		earl Mar		arrive c Illinois	NS	Summarizing other studies.
Sheldon 1967		Apr		arrive Michigan	NS	Summarizing other studies.
Sheldon 1967		Mar		arrive Pennsylvania	NS	Summarizing other studies.
Sheldon 1967		Mar		arrive New		Summarizing other studies.

\*\*\*\*\* SPOTTED SANDPIPER \*\*\*\*\*

\*\*\* NORMALIZING AND CONTACT RATE FACTORS \*\*\*

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
<b>BODY WEIGHT</b>													
Maxson & Oring 1980	A	F	-	SP	47.1		g	43	50	9	Minnesota	island in lake	
	A	M	-	SP	37.9		g	34	41	8	1975-77		
Oring & Lank 1986	A	M	-	SP	41.3		g				Minnesota	island in lake	(N) Nesting.
	A	F	N	SP	49.7		g				1973-84		
PNC (unpubl.)	A	B	-	SP	40.4	6.15 SD	g	29.4	59.8	56	Pennsylvania	NS	Birds collected during the spring migration. As cited in Dunning 1984.
Poole 1938	-	-	-	-	47.5		g			NS	NS	NS	
<b>METABOLIC RATE (KCAL BASIS)</b>													
Kuenzel & Wiegert 1973	A	B	-	-	9.9		kcal/day				NS	lab	Estimated from a formula (Zar 1968) and an assumed body weight of 57 g from Palmer (1949).
Maxson & Oring 1980	A	F	B	SP	7.82		kcal/day			9	Minnesota	island in lake	(B) Basal metabolic rate. (1)
	A	M	B	SP	6.67		kcal/day			8	1975-77		Assuming body weights of 47.1 g for females and 36.9 g for males as reported by Maxson and Oring 1980.
	A	F	1	SP	166		kcal/kg-d						
	A	M	1	SP	176		kcal/kg-d						
Maxson & Oring 1980	E	-	-	-	18		kcal/egg				Minnesota 1975-77	island in lake	Estimated energetic cost of producing an egg.
Maxson & Oring 1980	A	F	P	SP	19-37		kcal/day				Minnesota	island in lake	Estimated daily energy expenditure for females (P) pre-breeding, (L) laying, and (I) incubating.
	A	F	L	SP	18-35		kcal/day				1975-77		
	A	F	I	SU	17.3		kcal/day						
Maxson & Oring 1980	A	M	P	SP	16.3		kcal/day				Minnesota	island in lake	Estimated daily energy expenditure for males during (P) pre-breeding, (L) female laying, (I) incubating, and (B) brooding stages; assuming weight of 37.9 g.
	A	M	L	SP	14.4		kcal/day				1975-77		
	A	M	I	SU	11.2		kcal/day						
	A	M	B	SU	15.7		kcal/day						
Maxson & Oring 1980	A	F	P	SP	404-787		kcal/g-day				Minnesota	island in lake	Estimated daily energy expenditure for females (P) pre-breeding, (L) laying, and (I) incubating, assuming weight of 47.1 g.
	A	F	L	SP	383-745		kcal/g-day				1975-77		
	A	F	I	SU	368		kcal/g-day						

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Maxson & Oring 1980	A	M	P	SP	440		kcal/g-day				Minnesota 1975-77	island in lake	Estimated daily energy expenditure for males during (P) pre-breeding, (L) female laying, (I) incubating, and (B) brooding. stages.
	A	M	L	SP	390		kcal/g-day						
	A	M	I	SU	303		kcal/g-day						
	A	M	B	SU	425		kcal/g-day						

\*\*\* DIET \*\*\*

Reference	Age	Sex	Food type	Spring	Summer	Fall	Winter	N	Location	Habitat - Measure	Notes
Maxson & Oring 1980			mayflies		√				Minnesota 1975-77	island in lake -	Determined by setting insect traps in prime foraging areas.
			midges		√						

\*\*\* POPULATION DYNAMICS \*\*\*

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
POPULATION DENSITY													
Oring et al. 1983	A	F	-	SU	10		N/ha	3.8	12.5		Minnesota 1974-82	island in lake	
	A	M	-	SU	13.9		n/ha	7.5	20.0				
CLUTCH SIZE													
Bent 1929		-	-	-	4		eggs	3	5		NS	NS	
Oring & Lank 1986		-	-	-	4		eggs				Minnesota 1973-84	island in lake	
Oring et al. 1983		-	-	-	3.6		eggs			9 yr	Minnesota 1974-82	island in lake	They are determinate layers with clutch size = 4. Clutches with fewer eggs are not complete or have lost eggs; larger clutches are the result of more than one female laying in one nest.
Oring et al. 1983	-	-	-	-	38.7		%eggs hatc	0.019	0.667	1142	Minnesota 1974-82	island in lake	
	-	-	-	-	61.3		%not hatch						

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
CLUTCHES/YEAR													
Oring et al. 1984	A	F	-	SU			clutch/yr		4-6		Minnesota	island in lake	
Oring et al. 1991b	-	M	-	-			clutch/yr		1		Minnesota 1975-89	island in lake	Value is for number of successful clutches/year per male; in this case successful clutch assumed to mean one that fledged young.
Oring et al. 1991a	-	F	-	-			clutch/yr		5		Minnesota 1974-90	island in lake	Number of clutches laid by female; each clutch could involve a different mate, but a male will often receive a second clutch if his first is destroyed.
DAYS INCUBATION													
Oring (unpubl.)	-				18-24		days				Minnesota	island in lake	Oring pers. comm.
Oring et al. 1991a	-	-	-	-	20		days				Minnesota 1974-90	island in lake	Approximate.
AGE AT FLEDGING													
Oring et al. 1991a	-	-	-	-	18		days				Minnesota 1974-90	island in lake	Approximate.
N FLEDGE/ACTIVE NEST													
Oring 1982	-	-	1	-	1.2		chcks/F-yr			59	Minnesota 1975-81	island in lake	Number of chicks fledged per female per year for: (1) monogamous, (2) bigamous, (3) trigamous, and (4) quadragamous females. Some females may be excluded from breeding.
	-	-	2	-	2.6		chcks/F-yr			50			
	-	-	3	-	2.9		chcks/F-yr			15			
	-	-	4	-	1.0		chcks/F-yr			2			
N FLEDGE/SUCCESSFUL NEST													
Oring et al. 1983	-	-	-	-	1.83		N/nst hatc	0.58	2.76	140	Minnesota	island in lake	1.83 fledged out of nests at which at least one egg hatched. 2.58 fledged out of nests where at least one chick fledged. Young fledged/nest with eggs hatching (140 nests).
	-	-	-	-	2.58		N/suc nest	1.67	2.91	99			

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
AGE AT SEXUAL MATURITY													
Oring et al. 1983	-	F			1		year				Minnesota	island in lake	
	-	M			1		year				1974-82		
LONGEVITY													
Oring et al. 1983	A	F	-	-	3.7		years				Minnesota	island in lake	
											1974-82		
Oring et al. 1991a	A	M	-	-	2.8	2.0 SD	years				Minnesota	island in lake	Number of years breeding on the island; presumed very similar to longevity.
	A	F	-	-	3.0	1.9 SD	years				1974-90		
*** SEASONAL ACTIVITIES ***													
Reference	Begin				Peak	End				Location	Habitat	Notes	
MATING/LAYING													
Lank et al. 1985	earl May				May-June					Minnesota	island in lake	The peak of the mating season is from late May to early June.	
										1973-82			
HATCHING													
Lank et al. 1985	earl Jun				late Jun					Minnesota	island in lake		
										1973-82			
FALL/BASIC MOLT													
Bent 1929	Aug					Oct				NS	NS		
SPRING/ALTERNATE MOLT													
Bent 1929					Mar - Apr					NS	NS	Partial prenuptial molt.	
FALL MIGRATION													
Lank et al. 1985	late Jun				ear-mid July					Minnesota	island in lake	Adult females.	
										1973-82			
Lank et al. 1985	earl Jul				mid July					Minnesota	island in lake	Adult males.	
										1973-82			

\*\*\*\*\* HERRING GULL \*\*\*\*\*

\*\*\* NORMALIZING AND CONTACT RATE FACTORS \*\*\*

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
BODY WEIGHT													
Belopolskii 1957	A	F	BR	-	1,044		g	717	1,385	139	Barents Sea (Arctic)	coastal	As cited in Dunning 1984.
	A	M	BR	-	1,226		g	755	1,495	220			
Coulson et al. 1982	A	M	1	-	1,009	77.3	SD g			84	Scotland 1972-81	Isle of May	Data from birds culled during the breeding season. Between 1972 and 1981 large numbers of birds were culled each year; the breeding density of gulls in 1981 was about one fourth the breeding density in 1972. Year gulls culled: (1) 1972; (2) 1976; (3) 1981.
	A	F	1	-	849	69.1	SD g			72			
	A	M	2	-	1,042	68.7	SD g			68			
	A	F	2	-	862	61.6	SD g			70			
	A	M	3	-	1,054	93.4	SD g			129			
	A	F	3	-	888	65.9	SD g			159			
Harris 1964	A	M	-	-	980		g				Wales 1962	Skomer Island cliffs	
	A	F	-	-	815		g						
Morris & Black 1980	A	F	BR	-	973		g	910	1,010	3	Ontario, CAN 1978	n shore Lake Erie	Birds with active nests; used in radiotelemetry study.
	A	M	BR	-	1,280		g	1,260	1,300	2			
Norstrom et al. 1986	A	F	1	SP	920	57	SD g			10	Lake Huron 1980	island	Collection dates: (1) April 1; (2) May 15; (3) June 19-25; (4) July 30.
	A	F	2	SP	951	88	SD g			10			
	A	F	3	SU	863	72	SD g			10			
	A	F	4	SU	918	80	SD g			10			
Norstrom et al. 1986	A	M	1	SP	1,047	58	SD g			7	Lake Huron 1980-81	island	Collection dates: (1) May 5, 1981; (2) May 15, 1980; (3) May 18-23, 1980.
	A	M	2	SP	1,184	116	SD g			9			
	A	M	3	SP	1,180	69	SD g			6			
Poole 1938	-	-	-	-	850		g			1	NS	NS	
Threlfall & Jewer 1978	A	M	-	SU	1,232	106.6	SD g	1,014	1,618	180	Newfoundland, CAN	bay	Years: 1962-64 and 1966-68.
	A	F	-	SU	999	89.7	SD g	832	1,274	78			
BODY FAT													
Norstrom et al. 1986	A	M	1	SP	7.5	1.9	SD % lipid			7	Lake Huron 1980-81	island	Collection dates: (1) May 5, 1981; (2) May 15, 1980; (3) May 18-23, 1980.
	A	M	2	SP	10.0	2.2	SD % lipid			9			
	A	M	3	SP	11.3	3.0	SD % lipid			6			

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Norstrom et al. 1986	A	F	1	SP	18.3	5.4	SD % lipid			10	Lake Huron	island	Collection dates: (1) April 1; (2) May 15; (3) June 19-25; (4) July 30.
	A	F	2	SP	8.2	2.0	SD % lipid			10	1980		
	A	F	3	SU	8.7	2.3	SD % lipid			10			
	A	F	4	SU	7.7	2.1	SD % lipid			10			
EGG WEIGHT													
Harris 1964	E	-	1	-	84.68		g				Wales 1962	Skomer Island cliffs	Total of 100 eggs measured: (1) first-laid egg; (2) second-laid egg; (3) third-laid egg. Weight was calculated by author from a calculated egg volume (in cubic centimeters) using a specific gravity value of 1.11.
	E	-	2	-	85.03		g						
	E	-	3	-	75.31		g						
Hebert & Barclay 1988	E	-	1	-	87.16		g			138	New Brunswick,	island	Weighted mean egg weight for eggs from (1) three egg clutches and (2) two egg clutches.
	E	-	2	-	85.68		g			160	CAN		
Meathrel et al. 1987	E	-	1	-	7.5	0.51	SD g lipid			36	Lake Superior,	island	Egg lipids measured in two years: (1) 1983, (2) 1984.
	E	-	2	-	7.45	0.59	SD g lipid			45	CAN		
Meathrel et al. 1987	E	-	1	-	143.72	9.58	SD kcal/egg			36	Lake Superior,	island	Egg energy content (kcal/egg) measured in two years: (1) 1983, (2) 1984.
	E	-	2	-	144.53	8.71	SD kcal/egg			45	CAN		
Meathrel et al. 1987	E	-	1	-	66.92	5.32	SD g water			36	Lake Superior,	island	Egg water content (g/egg) measured in two years: (1) 1983, (2) 1984.
	E	-	2	-	68.89	5.54	SD g water			45	CAN		
Meathrel et al. 1987	E	-	1	-	92.0	5.9	SD g			93	Lake Superior,	islands	Year: (1) 1983, (2) 1984.
	E	-	2	-	98.0	8.0	SD g			156	CAN		
Pierotti 1982	E	-	1	-	91.1	7.9	SD g			120	Newfoundland,	Great Island, grassy	Laying order of eggs: (1) first; (2) second; (3) third.
	E	-	2	-	88.4	7.4	SD g			111	CAN 1977	slope	
	E	-	3	-	81.2	6.3	SD g			40			
Pierotti 1982	E	-	1	-	94.8	7.9	SD g			134	Newfoundland,	Great Island, grassy	Laying order of eggs: (1) first; (2) second; (3) third.
	E	-	2	-	92.7	7.7	SD g			127	CAN 1978	slope	
	E	-	3	-	86.7	7.0	SD g			102			
HATCHING WEIGHT													
Hebert & Barclay 1986	H	-	1	-	63.32	4.94	SD g			14	New Brunswick,	island	Hatchlings from: (1) 1st laid egg; (2) 2nd laid egg; (3) 3rd egg laid. SD estimated from SE and N.
	H	-	2	-	63.42	6.21	SD g			14	CAN 1984		
	H	-	3	-	57.00	7.78	SD g			14			
	H	-	AV	-	61.22	10.95	SD g			42			



Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Pierotti 1982	H	-	1	-	68.9	6.2	SD g			85	Newfoundland, CAN 1977	Great Island, rocky	Masses of chicks from: (1) first-laid eggs; (2) third-laid eggs.
	H	-	2	-	61.7	7.2	SD g			50			
Pierotti 1982	H	-	1	-	66.3	6.8	SD g			85	Newfoundland, CAN 1977	Great island, grassy slope	Masses of chicks from: (1) first-laid eggs; (2) third-laid eggs.
	H	-	2	-	57.9	5.5	SD g			51			
Pierotti 1982	H	-	1	-	65.5	6.3	SD g			63	Newfoundland, CAN 1977	Great Island, meadow	Masses of chicks from: (1) first-laid eggs; (2) third-laid eggs.
	H	-	2	-	57.1	6.3	SD g			34			
Pierotti 1982	H	-	1	-	70.0	5.9	SD g			82	Newfoundland, CAN 1978	Great Island, rocky	Masses of chicks from: (1) first-laid eggs; (2) third-laid eggs.
	H	-	2	-	63.9	5.1	SD g			56			
Pierotti 1982	H	-	1	-	66.0	6.0	SD g			92	Newfoundland, CAN 1978	Great Island, grassy slope	Masses of chicks from: (1) first-laid eggs; (2) third-laid eggs.
	H	-	2	-	60.0	5.8	SD g			49			
Pierotti 1982	H	-	1	-	66.1	7.3	SD g			58	Newfoundland, CAN 1978	Great Island, meadow	Masses of chicks from: (1) first-laid eggs; (2) third-laid eggs.
	H	-	2	-	59.6	7.1	SD g			33			
CHICK WEIGHT													
Dunn & Brisbin 1980	C	B	1	SU	65		g	50	80		Maine 1972-73	coastal island	Ages of chicks (C): (1) at hatching; (2) 10 days; (3) 20 days; (4) 30 days. Estimated from Figure 1 in Dunn & Brisbin 1980.
	C	B	2	SU	230		g	120	380				
	C	B	3	SU	590		g	420	800				
	C	B	4	SU	810		g	610	1,000				
CHICK GROWTH RATE													
Haycock & Threlfall 1975	C	-	-	-			g/day		40		Newfoundland, CAN 1969-71	Gull Island	Maximum weight growth of the chicks occurred at about 18 days of age.
Hebert & Barclay 1986	C	B	1	SU	1.08	1.01	SE g/day			13	New Brunswick, CAN	island	Up to 5 days of age only. (1) 1st hatched; (2) 2nd hatched; (3) 3rd hatched. SD can't be estimated from SE because SE appears to be too high given the available data.
	C	B	2	SU	1.07	1.01	SE g/day			13			
	C	B	3	SU	1.02	1.02	SE g/day			5			
	C	B	AV	SU	1.06	1.01	SE g/day			31			
Hunt 1972	C	B	-	SU	30.18	1.75	SD g/day	26.7	31.4	136	Maine 1968-70	coastal islands	Between 5 and 25 days of age.
Kadlec et al. 1969	C	-	1	-	28.8		g/day			20	Massachusetts 1964	Gray's Rock (island)	Growth rate from (1) day 5 to day 30; (2) day 30 to day 50. Only six of the original twenty presumed to have lived to fledging.
	C	-	2	-	10.3		g/day			20			

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Pierotti 1982	-	-	1	-	32.11	3.98	SD g/day			93	Newfoundland,	Great Island, rocky	Growth rate from day 5 to day 30.
	-	-	2	-	33.39	4.72	SD g/day			89	CAN		Year: (1) 1977; (2) 1978.
Pierotti 1982	-	-	1	-	28.99	7.03	SD g/day			111	Newfoundland,	grassy slope	Habitat is on Great Island. Growth
	-	-	2	-	31.38	4.57	SD g/day			119	CAN		rate from day 5 to day 30. Year: (1) 1977; (2) 1978.
Pierotti 1982	-	-	1	-	26.27	6.53	SD g/day			79	Newfoundland,	Great Island, meadow	Growth rate from day 5 to day 30.
	-	-	2	-	31.68	5.43	SD g/day			80	CAN		Year: (1) 1977; (2) 1978.
Pierotti 1982	-	-	1	-	8.8		g/day			115	Newfoundland,	Great Island, rocky	Estimates of growth rate from day 0
	-	-	2	-	13.1		g/day			85	CAN		- day 5 based on Tables 6, 7 & 8 (all chicks combined). N = number of chicks weighed on day 5. Year: (1) 1977; (2) 1978.
Pierotti 1982	-	-	1	-	11.7		g/day			125	Newfoundland,	grassy slope	Habitat is on Great Island.
	-	-	2	-	13.1		g/day			146	CAN		Estimates of growth rate from day 0 - day 5 based on Tables 6, 7 & 8 (all chicks combined). N = number of chicks weighed on day 5. Year: (1) 1977; (2) 1978.
Pierotti 1982	-	-	1	-	9.4		g/day			98	Newfoundland,	Great Island, meadow	Estimates of growth rate from day 0
	-	-	2	-	11.2		g/day			88	CAN		- day 5 based on Tables 6, 7 & 8 (all chicks combined). N = number of chicks weighed on day 5. Year: (1) 1977; (2) 1978.
<b>FLEDGING WEIGHT</b>													
Pierotti 1982	F	-	1	-	912.2	100.1	SD g			29	Newfoundland,	Great Island, rocky	Masses of 30-day old chicks from:
	F	-	2	-	887.4	93.4	SD g			22	CAN 1977		(1) first-laid eggs; (2)
	F	-	3	-	853.4	90.2	SD g			14			second-laid eggs; (3) third-laid eggs.
Pierotti 1982	F	-	1	-	818.0	99.2	SD g			27	Newfoundland,	Great Island, grassy	Masses of 30-day old chicks from:
	F	-	2	-	825.3	99.1	SD g			28	CAN 1977	slope	(1) first-laid eggs; (2)
	F	-	3	-	776.3	83.6	SD g			13			second-laid eggs; (3) third-laid eggs.
Pierotti 1982	F	-	1	-	832.9	90.7	SD g			16	Newfoundland,	Great Island, meadow	Masses of 30-day old chicks from:
	F	-	2	-	842.2	90.6	SD g			22	CAN 1977		(1) first-laid eggs; (2)
	F	-	3	-	759.4	75.3	SD g			10			second-laid eggs; (3) third-laid eggs.

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Pierotti 1982	F	-	1	-	964.4	77.3	SD g			20	Newfoundland, CAN 1978	Great Island, rocky	Masses of 30-day old chicks from: (1) first-laid eggs; (2) second-laid eggs; (3) third-laid eggs.
	F	-	2	-	974.8	98.1	SD g			16			
	F	-	3	-	985.5	88.8	SD g			11			
Pierotti 1982	F	-	1	-	899.3	103.3	SD g			30	Newfoundland, CAN 1978	Great Island, grassy slope	Masses of 30-day old chicks from: (1) first-laid eggs; (2) second-laid eggs; (3) third-laid eggs.
	F	-	2	-	909.4	102.3	SD g			17			
	F	-	3	-	913.3	85.7	SD g			12			
Pierotti 1982	F	-	1	-	935.6	99.6	SD g			15	Newfoundland, CAN 1978	Great Island, meadow	Masses of 30-day old chicks from: (1) first-laid eggs; (2) second-laid eggs; (3) third-laid eggs.
	F	-	2	-	976.2	77.3	SD g			29			
	F	-	3	-	952.5	61.2	SD g			11			
METABOLIC RATE (KCAL BASIS)													
Dunn 1980	C	B	1	SU	110		kcal/day				Maine 1972	coastal island	Estimated total energy requirement of free-living chicks under natural conditions (C) as they grow: (1) 10 days of age; (2) 20 days; (3) 30 days; (4) 40 days. Estimated from figure.
	C	B	2	SU	185		kcal/day						
	C	B	3	SU	230		kcal/day						
	C	B	4	SU	250		kcal/day						
Dunn 1976	C	B	1	SU	8		kcal/day				Maine 1972	coastal island	Estimated existence energy of chicks under natural conditions (C) as they grow: (1) at hatching; (2) 10 days of age; (3) 20 days; (4) 30 days; (5) 40 days; (6) 50 days. Estimated from Figure 2 in Dunn 1976 for sunny and shady locations.
	C	B	2	SU	50		kcal/day						
	C	B	3	SU	100		kcal/day						
	C	B	4	SU	137		kcal/day						
	C	B	5	SU	155		kcal/day						
	C	B	6	SU	155		kcal/day						
Lustick et al. 1978	A	-	B	-	99		kcal/kg-d					laboratory	
Norstrom et al. 1986	C	B	1	SU	100		kcal/day				NS	captive	Metabolizable energy intake of chicks (C) at ages: (1) 10 days; (2) 20 days; (3) 30 days. From a 1973 study by Gilman (1978, unpublished thesis).
	C	B	2	SU	190		kcal/day						
	C	B	3	SU	250		kcal/day						
Sibly & McCleery 1983	A	M	I	SU	79.2		kcal/day				England 1976-77	marine island	Weights of birds not reported. I = incubating.
	A	F	I	SU	67.2		kcal/day						

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
present study	A	M	I	-	97.1		kcal/kg-d				NS	NS	Estimated using the metabolic rate data of Sibly and McCleery (1983) and the body weights reported by Belopolskii (1957).
	A	F	I	-	70.2		kcal/kg-d						
FOOD INGESTION RATE													
Pierotti & Annett 1991	A	M	BR	SU	0.20		g/g-day				Newfoundland	NS	Diet of mussels. Estimated using 11.2 meals of mussel consumed per day per pair, weight of 80 g per mussel meal of which half is shell and not included in ingestion rate, assuming that the female accounts for 46% of pair's energy requirement and the male accounts for 54%, and using the body weights of Threfall and Jewer 1978.
	A	F	BR	SU	0.21		g/g-day						
Pierotti & Annett 1991	A	M	BR	SU	0.19		g/g-day				Newfoundland	NS	Diet of garbage. Estimated using 4.2 meals of garbage consumed per day per pair, weight of 100 g per garbage meal, assuming that the female accounts for 46% of pair's energy requirement and the male accounts for 54%, and using body weights of Threfall and Jewer 1978.
	A	F	BR	SU	0.18		g/g-day						
THERMONEUTRAL ZONE													
Lustick et al. 1979	J	B	-	-			degrees C	17.5	30		Ohio, Michigan	lab	Oxygen consumption increased above and below these temperatures.

\*\*\* DIET \*\*\*

Reference	Age	Sex	Food type	Spring	Summer	Fall	Winter	N	Location	Habitat - Measure	Notes
Burger 1988	-	-	snails		3			21	CA,FL,NY,NJ,TX	terrest., coastal, open water -	Birds feeding offshore not evaluated.
			crabs		14						
			garbage		27						
			offal		5						
			worms		23						
			other inverts.		28						
			fish		?						

Reference	Age	Sex	Food type	Spring	Summer	Fall	Winter	N	Location	Habitat - Measure	Notes
Ewins et al. (unpubl. manuscript)	A	B	fish mammal bird invertebrate plant garbage				76 5 1 1 16 -	231	Lake Erie 1978-91	Middle Island - % of total diet items; regurgitated pellets and faeces	Fish were comprised of more than 90 % <i>Aplodinotus grunniens</i> (freshwater drum) and a few percent <i>Perca flavescens</i> (yellow perch).
Ewins et al. (unpubl. manuscript)	A	B	fish mammal bird invertebrate plant garbage				50 1 16 30 15 45	151	Niagara River 1978-91	river - % frequency; regurgitated pellets and faeces	Fish were comprised mostly of <i>Osmerus mordax</i> (rainbow smelt), <i>Ictalurus nebulosus</i> (brown bullhead), <i>Nuturus flavus</i> (stonecat), <i>Alosa pseudoharengus</i> (alewife); mammals consisted of voles and mice.
Ewins et al. (unpubl. manuscript)	A	B	fish mammal bird invertebrate plant garbage				5 78 10 2 1 3	167	Lake Huron 1978-91	Chantry Island - % of total diet items; regurgitated pellets and faeces	The fish were largely unidentified to species.
Ewins et al. (unpubl. manuscript)	A	B	fish mammal bird invertebrate plant garbage				98 4 18 5 21 7	224	Lake Ontario 1978-91	Scotch Bonnet Island - % of total diet items; regurgitated pellets and faeces	Fish consisted predominantly of <i>Alosa pseudoharengus</i> (alewife) and <i>Osmerus mordax</i> (rainbow smelt).
Ewins et al. (unpubl. manuscript)	A	B	fish mammal bird invertebrate plant garbage				76 23 5 13 33 15	211	Lake Ontario 1978-91	Snake Island - % of total diet items; regurgitated pellets and faeces	Fish consisted primarily of <i>Alosa pseudoharengus</i> (alewife), <i>Amploplites rupestris</i> (rock bass), and <i>Perca flavescens</i> (yellow perch).
Ewins et al. (unpubl. manuscript)	A	B	alewife freshwater drum rainbow smelt sunfishes perch				35 23 13 11 11	1477	Great Lakes 1978-91	various - % frequency; regurgitated pellets and faeces	Summary of findings for all locations; sample size = 1298 pellets and 179 faeces examined.
Fox et al. 1990	A	B	Year: American smelt alewife other fish birds voles insects & refuse (N)	1978 46.1 23.1 20.5 2.6 2.6 12.8 (31)	1979 18.4 73.7 0.0 2.6 2.6 0 (23)	1980 61.2 16.7 3.4 13.8 3.4 3.4 (15)	1981 57.8 23.4 3.1 6.2 9.4 0 (26)		Lake Ontario 1978-81	Gull Island - % of items; incubating adult regurgitation	All collections made during the summer. Other fish included yellow perch, sunfish, carp, smallmouth bass, and unidentified cyprinids. Shows annual variation in composition of diet.

Reference	Age	Sex	Food type	Spring	Summer	Fall	Winter	N	Location	Habitat - Measure	Notes
Fox et al. 1990	C	B	Lake:	Ontario	Erie	Huron	Superior		Great Lakes 1977-83	islands - % of occurrence; boli regurgitated by chicks	Season is summer for all data. Shows variations in diet among colonies.
			fish	91.8	94.1	75.8	38.6				
			insects	5.5	5.9	5.6	42.1				
			offal, garbage	0.5	2.9	13.6	21.0				
			gull chicks/ ducklings	2.2	-	1.0	-				
			adult birds	1.6	-	1.0	3.5				
			amphibians/aquatic larvae	0.5	-	-	-				
			earthworms	2.2	-	11.6	1.7				
			crayfish	-	-	0.5	-				
			(N)	(182)	(34)	(198)	(57)				
Fox et al. 1990	A	B	American smelt		35.6			132	Lake Ontario 1978-83	islands - % of occurrence; incubating adult regurgitation	Most data from regurgitations of incubating adults, but includes data from 7 observations of prey consumption and stomach contents of four incubating adults. Season is mid-April to mid-July.
			alewife		28.8						
			other fish		9.1						
			unidentified fish		8.3						
			birds		9.8						
			voles		8.3						
			refuse, offal		4.5						
			insects		3.0						
			bird eggs		1.5						
			earthworms		0.8						
			amphibians		0.8						
			crayfish		0.8						
Haycock & Threlfall 1975	-	-	Months:	Mid-May	Mid-Jun	Mid-Jul			Newfoundland, CAN 1970-71	Gull Island - % of occurrence; regurgitation and pellets	Common names of species: Hyas sp.(crab), Oniscus sp. (woodlice), Acmaea sp. (limpet), Mytilus edulis (blue mussel), Illex illecebrosus (northern shortfin squid), Asterias sp. (starfish), Rana clamitans (frog), Oceanodroma leucorhoa (Leach's Storm-Petrel), Fratercula arctica (Atlantic puffin), Fratercula (puffin), Uria (murre), Larus sp. (gull), Rissa tridactyla (kittiwake), Vaccinum angustifolium (blueberries), and Gadus morhua (Atlantic cod). Fish include Atlantic herring, Atlantic tomcod, and small Atlantic cod, capelin, and American sand lance.
				Mid-Jun	Mid-Jul	Mid-Aug					
			Hyas sp.	0.7	0.0	0.0					
			Oniscus sp.	0.0	1.7	0.0					
			insects	0.0	2.7	2.3					
			Acmaea sp.	0.3	0.0	0.0					
			Mytilus edulis	30.9	0.9	9.1					
			Illex illecebrosus	0.0	0.0	1.5					
			Asterias sp.	0.0	0.9	0.7					
			sea urchin	5.8	0.0	4.5					
			fish	11.4	71.1	18.9					
			Rana clamitans	0.0	1.7	0.0					
			Oceanodroma leucorhoa	22.4	7.0	15.9					
			Fratercula arctica adults	5.8	0.0	1.5					
			Fratercula, Uria chicks	0.0	3.5	9.1					
			Fratercula, Uria eggs	1.4	1.7	0.8					
			Larus sp. chicks	0.0	0.9	2.3					
			Larus sp. eggs	3.1	5.3	0.8					
(continued)											

Reference	Age	Sex	Food type	Spring	Summer	Fall	Winter	N	Location	Habitat - Measure	Notes
Haycock & Threlfall 1975 (continued)			Rissa tridactyla chicks	0.0	0.0	1.5					
			Vaccinium angustifolium	-	-	9.9					
			Gadus morhua offal	12.4	1.7	14.4					
			assorted refuse (N)	5.8 (291)	0.9 (114)	6.8 (132)					
Mendall 1939	-	-	(fish)		(76.90)			62	Maine 1936-37	inland lakes	Tabulation was of dry material and
			white perch		36.08					-	was made according to the
			sunfishes(Eupomotis gibbosus, Lepomis auritus)		10.10					% of total diet	percentage-by-bulk method as
			yellow perch		8.18					items; stomach	recommended by the Bureau of
			minnows		6.14					contents	Biological Survey.
			small-mouthed bass		4.00						
			common sucker		3.60						
			trout or salmon		2.00						
			unidentified fish		6.80						
			(misc. animal food)		(6.86)						
			insects(Hymenoptera, Coleoptera)		3.44						
			mollusks (Unionidae)		2.06						
			birds		1.36						
			(Compsothylpidae, Fringillidae)								
			(vegetable food)		(8.04)						
			misc. vegetation		4.64						
			(Algae, Carex, Graminae)								
			blueberries		3.40						
			(refuse)		(8.20)						
Pierotti & Annett 1987	B	B	DATE:	5/1-6/7	6/8-6/21	6/22-7/7	7/8-7/23	NS	Newfoundland, CAN	Great Island	Dates for food observations are
			mussels	1,744	312	61	1			-	given at the top of each of the
			(Mytilus edulis)							number of observed	four columns. Based on number of
			garbage	833	114	18	4			occurrences -- see	occurrences observed in remains at
			Leach's storm petrel	509	58	28	2			notes	nest, food fed to mates, or adult
			(Oceanodroma leuc.)								regurgitate. Foods that make up
			capelin	0	118	233	124				less than 1% of diet not included.
			(Mallotus villosus)								Study shows shift in food taken
			squid	0	3	26	152				over the course of the reproductive
			(Illex illecebrosus)								period.
Vermeer 1973	-	-	plants		2			335	Manitoba, CAN	Kawinaw Lake	Summer = May and June.
			insects		TR				1971	-	
			crayfish		TR					% frequency of food	
			rodents		6					items; pellets	
			fish		94						

Reference	Age	Sex	Food type	Spring	Summer	Fall	Winter	N	Location	Habitat - Measure	Notes
Vermeer 1973	-	-	Catostomidae		73			335	Manitoba, CAN	Kawinaw Lake	Summer = May and June.
			unident. Percidae		38				1971	-	
			Perca flavescens		30					number of pellets	
			Esox lucius		9					containing fish	
			Stizostedion ritreum		4					species and families	
			Cyprinus carpio		4						
			Ictalurus nebulosus		1						

\*\*\* POPULATION DYNAMICS \*\*\*

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
<b>FORAGING RANGE</b>													
Pierotti pers. comm.	A	M	-	-	10 - 15		km	3	50	NS		coastal	
	A	F	-	-	5 - 10		km	3	25				
<b>POPULATION DENSITY</b>													
Brown 1967	-	-	-	SU	303		nests/ha		769		England 1962-65	low, gravelly island (Walney Island)	Mixed colony of herring gulls and lesser black-backed gulls; both types of nests included in density estimate. Author notes this is the highest density recorded for a colony of this type.
Haycock & Threlfall 1975	-	-	1	SU	389.1	154 SD	nests/ha				Newfoundland, CAN 1969-71	Gull Island	Densities of nests across various regions of Gull Island. Year: (1)1969; (2)1970; and (3)1971. Converted from nests/100 square meters.
	-	-	2	SU	295.8	43 SD	nests/ha						
	-	-	3	SU	383.0	128 SD	nests/ha						
Kadlec 1971	-	-	-	SU	226.8		nests/ha	137.6	350.2		Massachusetts 1964	coastal islands	Over four years.
Kadlec 1971	-	-	-	SU	139.3		nests/ha				Massachusetts 1964-69	coastal islands	At peak of nesting season (early June); over four years.
Morris & Haymes 1977	-	-	-	SU			nests/ha	290	360	237	ne Lake Erie 1973-76	rocky shore	Nest density during breeding season. Total of 0.17 ha of this habitat sampled each of four years.
Morris & Haymes 1977	-	-	-	SU			nests/ha	5	9	110	ne Lake Erie 1973-76	flat grassy area	Nest density during breeding season; total of 4.54 ha of this habitat sampled each of four years.
Parsons 1976b	-	-	-	SU	788		nests/ha			819	Scotland 1968	Isle of May	Nests found within a 1.04 ha area on the island.



Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Pierotti 1982	-	-	-	SU	74.7		nests/ha			1083	Newfoundland 1976-78	grassy slope	Habitat is on Great Island. N = number of nesting pairs. Total of 14.5 ha of grassy slope habitat available.
Pierotti 1982	-	-	-	SU	92.6		nests/ha			585	Newfoundland 1976-78	Great Island, meadow	N = number of nesting pairs. Total of 6.08 ha of meadow habitat available.
Pierotti 1982	-	-	-	SU	217.4		nests/ha			476	Newfoundland 1976-78	Great Island, rocky	N = number of nesting pairs. Total of 2.19 ha of meadow habitat available.
Schoen & Morris 1984	A	B	-	SU	20-25		pairs/ha				Ontario, CAN 1981	n shore Lake Erie, mainland	
Schoen & Morris 1984	A	B	-	SU	160-200		pairs/ha				Ontario, CAN 1981	n shore Lake Erie, insular rocky area	
Weseloh 1989	A	B	1	SU	0.0001		pairs/ha				s Ontario, CAN	NS	Total of 307 10 km squares sampled for breeding pairs in inland and lakeshore regions. Percent of squares with given density of pairs: (1) 10%; (2) 50%; (3) 28%; (4) 13%.
	A	B	2	SU			pairs/ha	0.0002	0.0010		1980s		
	A	B	3	SU			pairs/ha	0.0011	0.0100				
	A	B	4	SU			pairs/ha	0.0101	0.1000				
CLUTCH SIZE													
Brown 1967	-	-	1	-	2.77				3	40	England	low, gravelly island	Laying date of clutch: (1) to May 2; (2) May 3-7; (3) May 8-12; (4) after May 13.
	-	-	2	-	2.50				3	40	1962-65	(Walney Island)	
	-	-	3	-	2.51				3	29			
	-	-	4	-	2.40				3	30			
Burger & Shisler 1980	-	-	-	-	2.72		eggs	2.61	2.87	330	New Jersey 1976-77	coastal	Five study areas; min and max are means from different study sites.
Burger 1979b	-	-	-	-	2.78		eggs	2.51	2.90	1031	New Jersey 1977	salt marsh islands	Weighted average clutch size for 8 study sites and the minimum and maximum values from the 8 sites.
Burger 1980a	-	-	-	-	2.64		eggs	2.6	2.7	163	New Jersey 1976, 78	coastal	Weighted average of two years (listed in the minimum and maximum columns).
Burger 1977	-	-	1	-	2.83	0.39 SD	eggs			15	New Jersey	marsh	Average of clutch sizes in (1) dry, (2,3) wet-dry, and (4) wet habitats.
	-	-	2	-	2.71	0.40 SD	eggs			42	1974-75		
	-	-	3	-	2.66	0.64 SD	eggs			42			
	-	-	4	-	2.38	0.79 SD	eggs			25			

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Davis 1975	-	-	-	-	2.66		eggs			590	Scotland 1969-72	islands	Weight averaged over different laying periods.
Haycock & Threlfall 1975	-	-	1	-	2.70		eggs				Newfoundland, CAN 1970-71	Gull Island	N = number of nests. Years: (1)1970; (2)1971; and (3)1970-71. Only two nests with four eggs were seen among the 5000 nests examined in the two years. Mean for 1970 = maximum average clutch size reached in periodic surveys of the Point and east side Square. Mean for 1971 = average of 109 marked nests on the Point.
	-	-	2	-	2.73		eggs			109			
	-	-	3	-			eggs		4	5000			
Hunt 1972	-	-	-	-	2.38		eggs	2.3	2.8	11 yr	Maine 1968-70	coastal islands	Minimum and maximum values from 11 seasons.
Meathrel et al. 1987	-	-	-	-	2.84	0.44	SD eggs			782	Lake Superior, CAN	islands	Years 1975 through 1984 (except two).
Morris & Haymes 1977	-	-	-	-	2.65		eggs	1	5	100	Ontario, CAN 1973-75	n shore Lake Erie, flat grassy	Clutches of four or five were very rare.
Morris & Haymes 1977	-	-	-	-	2.79		eggs	1	5	231	Ontario, CAN 1973-76	n shore Lake Erie, rocky shore	Four and five egg clutches were very rare.
Nisbet & Drury 1984	-	-	-	-	2.54		eggs	1	6	24183	RI, MA, ME 1963-80	coastal	Surveyed just prior to hatching.
Parsons 1976b	-	-	-	-	2.71		eggs			771	Scotland 1968	Isle of May	Weighted average for all nests.
Paynter 1949	-	-	1	-	2.61	0.14	SE eggs			44	New Brunswick, CAN 1947	Kent Island	Clutch size of successful nests (hatched at least one bird): (1) at least one egg hatched before June 27 (early group); (2) eggs hatched after June 27 (late group).
	-	-	2	-	2.54	0.15	SE eggs			37			
Pierotti 1982	-	-	1	-	2.44	0.72	SD eggs			66	Newfoundland, CAN	Great Island, rocky	Year: (1) 1976; (2) 1977; (3) 1978.
	-	-	2	-	2.65	0.56	SD eggs			117			
	-	-	3	-	2.60	0.62	SD eggs			120			
Pierotti 1982	-	-	1	-	2.27	0.72	SD eggs			72	Newfoundland, CAN	grassy slope	Habitat is on Great Island. Year: (1) 1976; (2) 1977; (3) 1978.
	-	-	2	-	2.72	0.54	SD eggs			134			
	-	-	3	-	2.67	0.61	SD eggs			137			
Pierotti 1982	-	-	1	-	2.16	0.72	SD eggs			88	Newfoundland, CAN	Great Island, meadow	Year: (1) 1976; (2) 1977; (3) 1978.
	-	-	2	-	2.51	0.63	SD eggs			98			
	-	-	3	-	2.51	0.73	SD eggs			94			

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
<b>CLUTCHES/YEAR</b>													
Burger 1979a, Bourget 1973	-	-	-	-	1		clutch/yr	1	2*		NS	NS	* If first clutch lost.
<b>DAYS INCUBATION</b>													
Haycock & Threlfall 1975	-	-	-	-	29.4	1 SE	days			24	Newfoundland, CAN 1969-71	Gull Island	Average egg volume = 79cc.
Niebuhr 1983	-	-	-	-			days	25	28		Cumbria, England 1980	Walney Island	
Parsons 1972	-	-	1	-	29.1	0.11 SE	days			75	Scotland 1968	Isle of May	Incubation period for "late"-laid eggs (after May 24): (1) first-laid egg (mean volume = 77.1cc +/- 0.58 S.E.); (2) second-laid egg (mean volume = 74.7cc +/- 0.57); (3) third-laid egg (mean volume = 67.8cc +/- 0.56).
	-	-	2	-	27.7	0.12 SE	days			75			
	-	-	3	-	26.7	0.14 SE	days			75			
Parsons 1972	-	-	1	-	30.0	0.19 SE	days			28	Scotland 1968	Isle of May	Incubation period for "early"-laid eggs (before May 10): (1) first-laid egg (mean volume = 80.2cc +/- 0.98 S.E.); (2) second-laid egg (mean volume = 78.3cc +/- 1.07); (3) third-laid egg (mean volume = 71.0cc +/- 1.11).
	-	-	2	-	28.4	0.19 SE	days			28			
	-	-	3	-	27.5	0.18 SE	days			28			
Parsons 1972	-	-	1	-	29.98	0.08 SE	days			67	Scotland 1967-69	Isle of May	Incubation period of first-laid eggs. Egg size: (1) greater than 76cc (mean = 82cc); (2) less than 76cc (mean = 71cc). All eggs laid during peak of laying season.
	-	-	2	-	29.31	0.11 SE	days			67			
Pierotti 1982	-	-	1	-	29		days			351	Newfoundland, CAN 1978	Great Island	Incubation period for: (1) first-laid egg; (2) second-laid egg; (3) third-laid egg. N = number of nests; not all pairs incubated three eggs.
	-	-	2	-	27		days						
	-	-	3	-	26		days						
Tinbergen 1960	-	-	-	-	30.5		days	28	33		Holland	coastal	

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
<b>AGE AT FLEDGING</b>													
Haycock & Threlfall 1975	-	-	-	-	45.2		days	42	48	12	Newfoundland, CAN 1970	Gull Island	
Holley 1982	-	-	1	-	45		days			16	England	coastal	(1) Single chick broods; (2) multiple chick broods.
	-	-	2	-	48		days			3	1977-80		
Kadlec et al. 1969	-	-	-	-	51		days	35-44	56-61	6	Massachusetts 1964	Gray's Rock (island)	N = 6 chicks fledging.
Paynter 1949	-	-	-	-	43		days	31	52		New Brunswick, CAN 1947	Kent Island	
<b>N FLEDGE/ACTIVE NEST</b>													
Burger & Shisler 1980	-	-	-	-	1.42		N/act nest	1.4	1.44		New Jersey 1976-77	coastal	Average, minimum, and maximum of three colonies (with a total of 688 active nests).
Davis 1975	-	-	-	-	0.65		N/pair	0.25	0.85	2 yr	England 1970-71	coastal	Minimum reflects a subgroup of clutches laid in a "later" time period than average; max is a subgroup with "earlier" hatch dates.
Kadlec 1971	-	-	-	-	0.83	0.27 SD	N/nest	0.4	1.1		Massachusetts 1964-69	coastal islands	Average, minimum, and maximum values over 6 years with between 1,400 to 1,900 nests/year. Not specified whether per active or successful nest; we assume per active.
Kadlec & Drury 1968	-	-	1	-	1.47		N/act nest			233	Rhode Island	Block Island	Clutch size of nest: (1) 3 eggs;
	-	-	2	-	1.09		N/act nest			33	1966		(2) 2 eggs.
Kadlec & Drury 1968	-	-	1	-	1.00		N/act nest			216	Rhode Island, 1965	Block Island	Clutch size of nests: (1) 3 eggs;
	-	-	2	-	0.60		N/act nest			42			(2) 2 eggs.
Kadlec & Drury 1968	-	-	1	-	0.73		N/act nest			51	Massachusetts 1965	Marblehead Rock	Hatch date: (1) before June 11; (2) June 11 to June 24; (3) after June 24.
	-	-	2	-	1.09		N/act nest			159			
	-	-	3	-	0.62		N/act nest			52			
Kadlec & Drury 1968	-	-	1	-	1.53		N/act nest			128	Rhode Island	Block Island	Hatch date: (1) before June 11; (2) June 11 to 24; (3) after June 24.
	-	-	2	-	1.42		N/act nest			122	1966		
	-	-	3	-	1.12		N/act nest			8			
Keith 1966	-	-	-	-	0.3-0.4		N/pair				Michigan, early 1960s	lake	As cited in Peakall 1988. Low fledging success might have resulted from effects of DDE/DDT.

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Mineau et al. 1984	-	-	-	-	1.65		N/act nest	1.40	2.13	6	Lake Ontario 1979-81	lakeshore	N = 6 colony years. Min and max represent min and max average values of the 6 colony-years. The low reproductive success (< 1 fledge per nest) of these colonies in the early 1970's, attributed to organochlorine contaminants, was no longer apparent.
Mineau et al. 1984	-	-	-	-	1.78		N/act nest	1.62	2.10	3	Lake Erie 1979-81	lakeshore	N = 3 colony years. Min and max represent min and max average values of the 3 colony-years.
Mineau et al. 1984	-	-	-	-	2.19		N/act nest	2.16	2.25	6	Lake Huron 1979-81	lakeshore	N = 6 colony years. Min and max represent min and max average values of the 6 colony-years.
Morris & Haymes 1977	-	-	1	-	0.48	0.18 SE	N/act nest			21	Ontario, CAN	n shore Lake Erie,	Hatchlings considered to have fledged at 30 days of age. Year: (1) 1973; (2) 1974. Less than half of the eggs laid hatched; many were predated or addled -- authors suggest the low hatch rate may be due in part to the effects of pesticide related contaminants.
	-	-	2	-	0.32	0.10 SE	N/act nest			37	1973-74	grassy near shore	
Morris & Haymes 1977	-	-	1	-	0.48	0.08 SE	N/act nest			62	Ontario, CAN	n shore Lake Erie,	Hatchlings considered to have fledged at 30 days of age. Year: (1) 1974; (2) 1975; (3) 1976. Less than half of the eggs laid hatched; many were predated or addled -- authors suggest the low hatch rate may be due in part to the effects of pesticide related contaminants.
	-	-	2	-	0.45	0.13 SE	N/act nest			38	1974-76	rocky shore	
	-	-	3	-	0.79	0.13 SE	N/act nest			42			
Parsons 1976b	-	-	1	-	0.58	0.07 SE	N/act nest			155	Scotland 1968	Isle of May	(1) number of nests within 2.3 meters (NN) = 0; (2) NN = 1; (3) NN = 2; (4) NN = 3. Nesting success appears unusually low; reason unknown.
	-	-	2	-	0.72	0.06 SE	N/act nest			254			
	-	-	3	-	0.88	0.05 SE	N/act nest			259			
	-	-	4	-	0.52	0.08 SE	N/act nest			103			
Pierotti 1982	-	-	1	-	1.32	0.81 SD	N/act nest			59	Newfoundland,	Great Island, rocky	Year: (1) 1976; (2) 1977; (3) 1978.
	-	-	2	-	1.77	0.98 SD	N/act nest			106	CAN		
	-	-	3	-	1.84	0.96 SD	N/act nest			114			
Pierotti 1982	-	-	1	-	1.58	0.81 SD	N/act nest			59	Newfoundland,	grassy slope	Habitat is located on Great Island. Year: (1) 1976; (2) 1977; (3) 1978.
	-	-	2	-	1.87	1.01 SD	N/act nest			110	CAN		
	-	-	3	-	1.81	0.92 SD	N/act nest			133			

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Pierotti 1982	-	-	1	-	1.03	0.89	SD N/act nest			91	Newfoundland,	Great Island, meadow	Year: (1) 1976; (2) 1977; (3) 1978.
	-	-	2	-	1.19	1.00	SD N/act nest			98	CAN		
	-	-	3	-	1.28	1.00	SD N/act nest			99			
Pierotti & Annett 1987	-	-	1	-	2.14		N/act nest			167	Newfoundland,	Great Island	N = number of nests for gulls with dietary focus of: (1) mussels, (2) petrels, and (3) garbage.
	-	-	2	-	1.36		N/act nest			47	CAN 1978		
	-	-	3	-	0.68		N/act nest			58			
Schoen & Morris 1984	-	-	1	-	1.57	0.97	SD N/pair				Ontario, CAN 1981	n shore Lake Erie, insular rocks	
Schoen & Morris 1984	-	-	-	-	1.41	1.08	SD N/pair				Ontario, CAN 1981	n shore Lake Erie, mainland	
Weseloh et al. 1990	-	-	-	-				U 95% CL	L 95% CL		Lake Erie 1978	lakeshore	Numbers in max column are lower 95% confidence limits; numbers in min column are upper 95% confidence limits. Each entry reflects a different colony on Lake Erie and adjacent waters. Values are thought to represent a return to "normal" after a period of low reproductive success in this area from early 1970's to 1976.
	-	-	-	-	1.53		N/pair	1.67	1.39				
	-	-	-	-	1.67		N/pair	2.17	1.16				
	-	-	-	-	1.74		N/pair	1.92	1.55				
	-	-	-	-	1.70		N/pair	1.82	1.59				
	-	-	-	-	1.38		N/pair	1.43	1.34				
	-	-	-	-	1.45		N/pair	1.64	1.26				
N FLEDGE/SUCCESSFUL NEST													
Burger & Shisler 1980	-	-	-	-	1.8		N/act nest	1.79	1.80		New Jersey 1976-77	coastal	Averaged over three colonies (total of 550 nests at which at least one egg hatched).
PERCENT EGGS HATCHING													
Haycock & Threlfall 1975	-	-	1	-	72.9		% hatch			273	Newfoundland,	Gull Island	Average of first through third clutches. N = number of eggs laid. Location and year: (1)The Point, 1971; (2)predation nest area, 1969. Causes of hatching failure were identified as predation, disappearance without trace, death (no embryo), death while pipping.
	-	-	2	-	62.5		% hatch			88	CAN 1969-71		
Pierotti & Annett 1987	-	-	1	-	86.2		% hatch			376	Newfoundland,	Great Island	N = number of eggs laid by gulls with dietary focus of: (1) mussels, (2) petrels, (3) garbage, and (4) generalist feeding.
	-	-	2	-	62.9		% hatch			62	CAN 1977		
	-	-	3	-	42.4		% hatch			158			
	-	-	4	-	81.5		% hatch			168			

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
AGE AT SEXUAL MATURITY													
Coulson et al. 1982	-	B	1	-	5.8		years	4	8	85	Scotland 1972-81	Isle of May	Age at recruitment into the breeding population, based on a study of culled banded gulls. Breeding gulls were culled from 1972-81; this resulted in a 75% reduction of the 1972 breeding density by 1981. Prior to the start of the cull, there were no records of third year birds breeding at this location. Hatch year of gulls: (1) 1969; (2) 1970; (3) 1972; (4) 1973-75.
	-	B	2	-	5.6		years	3	7	57			
	-	B	3	-	5.3		years	3	6	334			
	-	B	4	-	4.3		years	3	5	448			
Greig et al. 1983	-	B	-	-	5		years				England		Not true mean; common value.
Kadlec & Drury 1968	A	B	-	-	4		years				New England	coastal/islands	
Pierotti pers. comm.	-	M	-	-	4		years				Newfoundland, CAN	NS	
	-	F	-	-	5		years						
ANNUAL MORTALITY													
Brown 1967	A	B	-	-	10		%/year				England 1962-65	low, gravelly island (Walney Island)	Adults four years and older.
Chabrzyk & Coulson 1976	J	B	-	-	22		%/1st yr	17	33	14000	Scotland	coastal	Bird banding experiment.
	A	B	-	-	7.3		%/2nd yr			14000			
Kadlec & Drury 1968	J	B	1	-	27		%/fled-Sep				New England 1920-64	coastal/islands	Based on age-class counts from banding data and assuming 4.7% population growth per year, 80% of adults breed per year, and production of one young per year by breeding pair. Age: (1) fledging to 1st September; (2) 1st Sept. to 1st March; (3) 1st March to 2nd March; (4) 2nd March to 3rd March; (5) 3rd March to 4rth March; (6) yearly adult mortality for 4 year-olds and up.
	J	B	2	-	25		%/Sep-Mar						
	J	B	3	-	20		%/year						
	J	B	4	-	9		%/year						
	J	B	5	-	8		%/year						
	A	B	6	-	8		%/year						
Kadlec 1976	A	B	-	-	15-20		%/yr				Massachusetts 1967-74	coastal island	Overestimate of mortality rate. Authors report that the age structure of the population is inconsistent with a mortality rate as high as 15 to 20 percent.

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Kadlec & Drury 1968	E	-	1	-	9		%/3 week				New England	coastal	Time period: (1) egg - from laying to 3 weeks old; (2) chick - from week of hatching to two weeks old; (3) chick - from third week after hatching to seventh week. Based on the assumption that one chick survives to fledging from each three eggs.
	C	-	2	-	51.7		%/0-2 week				1963		
	C	-	3	-	23.8		%/3-7 week						
Kadlec et al. 1969	C	-	-	-	41.8		% to d 15			1,726	Rhode Island 1965-67	Block Island	Mortality of chicks from hatch to day 15. Based on number of chicks found dead, and number "disappeared" and presumed dead.
Olsson 1958	A	B	-	-			%/yr	20	30		United States	NS	As cited in Chabryzk & Coulson 1976; based on recovery of ringed birds. Author thinks that these are too high.
<b>LONGEVITY</b>													
Gross 1940	-	-	-	-			years		45	1	New Brunswick, CAN	Kent Island	Also cites records of birds reaching 26 and 30. As cited in Paynter 1949.

\*\*\* SEASONAL ACTIVITIES \*\*\*

Reference	Begin	Peak	End	Location	Habitat	Notes
<b>MATING/LAYING</b>						
Bourget 1973	earl May	mid May	earl Jun	Maine 1969	bay	
Burger 1980a		May 5		New Jersey 1976-78	coastal	
Burger 1977, 1979b	May 4	May	Jun 18	New Jersey 1974-77	marsh islands	Across different years. Within any single year, the laying season is shorter.
Erwin 1971	late Apr	May 4-13	May 14-19	Rhode Island 1969	coastal island	
Haycock & Threlfall 1975	late Apr	mid May	late Jun	Newfoundland, CAN 1969-71	Gull Island	
Meathrel et al. 1987	May 6		May 15	Lake Superior, CAN	islands	In 1983.



Reference	Begin	Peak	End	Location	Habitat	Notes
Meathrel et al. 1987	May 11		May 25	Lake Superior, CAN	islands	In 1984.
Morris & Haymes 1977	late Apr	earl May	earl Jun	Ontario, CAN 1973-76	n shore Lake Erie	
Morris & Black 1980	21 Apr	26-27 Apr	17 May	Ontario, CAN 1978	n shore Lake Erie	Timing of initiation of clutches.
Pierotti 1982	earl May	late May	end May	Newfoundland, CAN 1977-78	Great Island	In general, first and second eggs are laid about two days apart; the third is laid one or two days after the second.
Schoen & Morris 1984		late Apr		Ontario, CAN 1981	n shore Lake Erie,	
<b>HATCHING</b>						
Bourget 1973	mid Jun	late Jun	mid Jul	Maine 1969	bay	
Fox et al. 1990		mid-late May		Great Lakes 1977-83	islands	
Kadlec 1971	May	Jun	Jul	Massachusetts 1964	coastal islands	
Paynter 1949	Jun 19	late Jun	Jul 14	New Brunswick, CAN 1947	Kent Island	
Pierotti 1982; 1987	earl Jun	mid June	end June	Newfoundland, CAN 1977-78	Great Island	
<b>FALL MIGRATION</b>						
Burger 1982	Aug		Sept	nw Atlantic populations		
Moore 1976	Nov	Dec	Mar	Great Lakes 1929-71	various	Juveniles and one-year olds only. Adults and two-year olds are year-round residents. Determined from band recoveries.
<b>SPRING MIGRATION</b>						
Burger 1982	Feb		late Apr	nw Atlantic populations		

